*भारतीय मानक*
*Indian Standard*

**IS 16947 : 2018**

# कांच के शीशे के साथ दरवाजे, खुलनेवाले खिड़कियां एवं सरकनेवाले दरवाजों के अग्नि प्रतिरोधक परीक्षण

# Fire Resistance Tests for Doors with Glass Panes, Openable Glass Windows and Sliding Glass Doors

ICS 13.220.50; 91.060.50

© BIS 2018

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुरशाह ज़फर मार्ग, नई दिल्ली – 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI-110002
www.bis.gov.in www.standardsbis.in

**June 2018** **Price Group 7**

Glass, Glassware and Laboratoryware Sectional Committee, CHD 10

## FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Glass, Glassware and Laboratoryware Sectional Committee had been approved by the Chemical Division Council.

With the rapid increase in construction and increasing number of mixed used buildings, it has become imperative to provide compartmentalized safe fire zones and exit routes. Since glass as a building material is being used extensively specifically in doors, and since it is a transparent medium and can transmit infrared radiation during a fire, it is important to assess the radiation levels transmitted through glass during a fire.

The committee has decided to formulate this standard to assess the behavior of a specimen (which is an element of building construction) when, subjected to defined heating and pressure conditions. The method provides a means of quantifying the ability of an element to withstand exposure to high temperatures, by setting criteria by which the fire containment (integrity), limiting the radiation (radiation criteria) and the thermal transmittance (insulation), functions amongst others can be evaluated.

In the formulation of this standard considerable assistance has been derived from the following International Standards:

a) EN 1363-1 : 1999 Fire resistance tests — Part 1: General requirements

b) EN 1363-2 : 1999 Fire resistance tests — Part 2: Alternative and additional procedures

c) BS EN 1634-1 : 2014 Fire resistance and smoke control tests for door and shutter assemblies, openable windows and elements of building hardware — Part 1: Fire resistance tests for door and shutter assemblies and openable windows

In reporting the result of a test or analysis made in accordance with this standard, if the final value, calculated or observed, is to be round off, it shall be done in accordance with IS 2 : 1960 'Rules for rounding off numerical values ( *revised* )'.

# *Indian Standard*

# FIRE RESISTANCE TESTS FOR DOORS WITH GLASS PANES, OPENABLE GLASS WINDOWS AND SLIDING GLASS DOORS

## 1 SCOPE

**1.1** This Indian Standard describes a method of test for determining the fire resistance behaviour of glass doors, shutters and openable windows, designed for installation within openings incorporated in vertical separating elements, such as hinged or pivoted doors, openable windows, sliding doors etc.

**1.2** The test provides for the determination of fire resistance of glass elements of architectural structures on the basis of the length of time for which the test specimens of specified dimensions satisfy the criteria laid down under the prescribed test conditions during the period of fire exposure.

## 2 REFERENCES

The standards given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

| *IS No.* | *Title* |
|---|---|
| IS 1382 : 1981 | Glossary of terms relating to glass and glassware (*first revision*) |
| IS 16231 (Part 3) : 2016 | Use of glass in buildings — Code of practice: Part 3 Fire and loading |
| IS 16945 : 2018 | Fire resistance tests for glass walls |

## 3 TERMINOLOGY

For the purpose of this standard, the terms and definitions as given in IS 1382 and IS 16945 shall apply in addition to the following.

### 3.1 Associated Supporting Construction

Specific construction in which the doorset or openable window, is to be installed in practice and which is used to close off the furnace and provide the levels of restraint and thermal heat transfer to be experienced in normal use

### 3.2 Building Hardware

Items such as hinges, handles, locks, exit devices, escutcheons, letter plates, kick plates, sliding gear, closing devices, electrical components, wiring, etc., which are, or can be, used in the doorset or openable window.

### 3.3 Door or Shutter Assembly Doorset

Pedestrian doorset or industrial type doorset, including any frame or guide, door leaf or leaves, rolling or folding curtain, etc., which is provided to give a fire resisting capability when used for the closing of permanent openings in fire resisting separating elements, which includes any side panel(s), vision panel(s), flush over panel(s) and/or transom panel(s) together with the building hardware and any seals (whether provided for the purpose of fire resistance or smoke control or for other purposes such as draught or acoustics) which form the assembly

### 3.4 Double Action

Action of a door leaf of a (single or double leaf) doorset that opens in two directions.

### 3.5 Floor

Upper surface of the horizontal element, on which the doorset or openable window is mounted and which extends from the exposed face to the unexposed face of the assembly.

### 3.6 Flush Over Panel

Panel which is incorporated within a doorset or openable window and fitted above the leaf or leaves within the frame head and the jambs and with no transom.

### 3.7 Gap

Clearance between two adjacent surfaces and/or edges, for example, between the edge of the leaf and the reveal of the frame or between the face of the leaf and the frame stop.

### 3.8 Integrity

The ability of a test specimen of a separating element of building construction when exposed to fire on one side to prevent the passage through it of flames and hot gases and to prevent the occurrence of flames on the unexposed side.

### 3.9 Insulation

The ability of a test specimen of a separating element of building construction when exposed to fire on one side, to restrict temperature rise of the unexposed face to below specified levels.

### 3.10 Openable (For Windows Only)

Applying to windows with one or more moveable leaf or leaves, including any side or over panel(s), perimeter frame and any elements of building hardware.

### 3.11 Radiation/Heat Flux

The quantity of heat energy, per unit area incident on the target of the measuring device. It includes heat transferred by convection as well as radiation.

### 3.12 Side Panel

Panel which is incorporated within a doorset or openable window and fitted at one side of a leaf and is bounded on all edges by the perimeter frame, the jambs and the transom (when applicable).

### 3.13 Sill

Member which connects two frame jambs together at the base which may or may not be set into the floor and remains visible.

### 3.14 Single Action

Action of a door leaf of a (single or double leaf) doorset that opens in only one direction.

### 3.15 Sponsor

The sponsor is the party which intends to do a fire test for its product in an authorized testing laboratory.

### 3.16 Standard Supporting Construction

Form of construction used to close off the furnace and to support the doorset or openable window being evaluated and which has a quantifiable influence on both the thermal heat transfer between the construction and the test specimen and provides known resistance to thermal distortion.

### 3.17 Sustained Flaming

Continuous flaming for a period of time greater than 10 seconds.

### 3.18 Test Specimen

Glass doorset or openable window which is to be installed in a standard or associated supporting construction to allow it to be evaluated.

### 3.19 Through Component/Connection

Internal spacer or fixing that either penetrates through the doorset or openable window from one face to another or directly connects the faces one to the other.

### 3.20 Transom

Member that extends across the frame from jamb to jamb at the head of the leaf and which creates an aperture to house a transom panel.

### 3.21 Transom Panel

Panel which is incorporated within a doorset or openable window and fitted above the leaf or leaves and is bounded on all edges by the frame head, the jambs and the transom.

## 4 APPARATUS

### 4.1 Furnace

**4.1.1** The test furnace shall be designed to employ liquid or gaseous fuels and shall be capable of:

a) Heating of vertical separating elements on one face;
b) Heating of columns on all sides;
c) Heating of walls on more than one side; or
d) Heating of beams on three or four sides, as appropriate.

**4.1.2** Other special furnaces may be used for specific elements.

**4.1.3** The furnace linings shall consist of materials with densities less than 1 000 kg/m$^3$. Such lining materials shall have a minimum thickness of 50 mm and shall constitute at least 70 percent of the internally exposed surface of the furnace. The furnace shall be capable of providing standard fire exposure conditions with respect to thermal exposure and pressure.

NOTE — Furnaces may be designed so that assemblies of more than one element can be tested simultaneously, provided all the requirements for each individual element can be complied with.

### 4.2 Test Frames

**4.2.1** Special test frames or other means shall be employed to reproduce the boundary and support conditions appropriate for the test constructions. Different types of test constructions will require test frames of different stiffness.

**4.2.2** The performance of the test frames shall be evaluated by applying an expansion force within the frame at mid-width between two opposite members and measuring the increase in the internal dimension. The increase shall not exceed 5 mm with an applied force of 25 kN. This evaluation shall be conducted in both the directions of the frame.

### 4.3 Measuring and Control Equipment

Equipment prescribed at **4.3.1** to **4.3.5** are essential to monitor the test construction, the laboratory and the furnace environment and the behavior of the test sample during the test.

**4.3.1** *Instrumentations*

**4.3.1.1** *Furnace thermocouples*

The furnace thermocouples shall be plate thermometers which comprise an assembly of a folded steel plate, the thermocouple fixed to it and containing insulation material. The plate shall be constructed from (150 ± 1) mm long × (100 ± 1) mm wide × (0.7 ± 0.1) mm thick nickel alloy sheet strips. The measuring junction shall consist of nickel chromium/nickel aluminium (type K) wire, contained within mineral insulation in a heat resisting steel alloy sheath of nominal diameter 1 mm, the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall be fixed to the geometric centre of the plate by a small steel strip. The steel strip can be welded to the plate or may be screwed to it to facilitate replacement of the thermocouple. The strip shall be approximately 18 mm × 6 mm if it is spot welded to the plate and nominally 25 mm × 6 mm if it is to be screwed to the plate. The screw shall be 2 mm in diameter. The assembly of plate and thermocouple shall be fitted with a pad of inorganic insulation material nominally (97 ± 1) mm × (97 ± 1) mm × (10 ± 1) mm, density 280 ± 30 kg/m$^3$. Before the plate thermometers are first used, the complete plate thermometer shall be aged by immersing in a pre-heated oven at 1 000°C for 1 h.

**4.3.1.2** *Fixed specimen thermocouples*

As prescribed in **4.4.1.2** of IS 16945.

**4.3.1.3** *Specimen internal thermocouples*

For measuring internal temperatures.

**4.3.1.4** *Deformation measuring devices*

As prescribed in **4.4.1.3** of IS 16945.

**4.3.1.5** *Radiometer*

As prescribed in **4.4.1.6** of IS 16945.

**4.3.2** *Cotton Pad*

As prescribed in **4.4.2** of IS 16945.

**4.3.3** *Gap Gauges*

As prescribed in **4.4.3** of IS 16945.

**4.3.4** *Devices Used for Recording*

a) furnace temperature,
b) furnace pressure, and
c) specimen interior temperature.

**4.3.5** *Other Ancillary Devices*

a) fixed and roving furnace temperature devices,
b) radiation measuring devices, and
c) timing devices.

## 5 TEST CONDITIONS

### 5.1 Heating Conditions

**5.1.1** *The Temperature/Time Conditions*

As prescribed in **5.1.1** a) of IS 16945.

**5.1.2** *Tolerances*

As prescribed in **5.1.2** of IS 16945.

**5.1.3** *Uniformity of Temperature Distribution*

As prescribed in **5.1.3** of IS 16945.

### 5.2 Pressure Conditions

As prescribed in **5.2** of IS 16945.

### 5.3 Ambient Conditions within the Laboratory

As prescribed in **5.3** of IS 16945 except that prior to the heating period the ambient temperature shall be within 5°C to 45°C.

### 5.4 Loss of Accuracy

As prescribed in **5.4** of IS 16945.

## 6 TEST SPECIMEN

### 6.1 Size

The test specimen and all its components shall be full size unless limited by the size of the front opening of the furnace which will normally be 3.0 m × 3.0 m. Doorsets and openable windows which cannot be tested at full size shall normally be tested to the maximum size possible consistent with **7.2**.

### 6.2 Number

As prescribed in **6.2** of IS 16945.

### 6.3 Design

**6.3.1** The design of the test specimen and the choice of supporting construction shall take into account the requirements of **12** if the widest field of direct application is to be achieved. The sponsor shall declare to the laboratory the design values for the gaps including tolerances.

**6.3.2** Where the doorset and openable window incorporates side, transom or flush over panels, whether glazed or unglazed, these shall be tested as part of the assembly. If only one side panel is incorporated, this shall always be installed on the latch side of the doorset and openable window.

**6.3.3** The test specimen shall be fully representative of the doorset and openable window intended for use in practice, including any appropriate surface finishes, elements of building hardware and fittings as these are an essential part of the test specimen and may influence its behaviour in the test.

### 6.4 Construction

As prescribed in **6.4** of IS 16945.

### 6.5 Verification

As prescribed in **6.5** of IS 16945.

### 6.6 Building Hardware

Any item of building hardware shall be measured, analysed and described in detail before the test commences. Where it is not possible to confirm the manufacturer's description it shall be clearly stated.

## 7 INSTALLATION OF TEST SPECIMEN

The test specimen shall be installed, as far as possible, in a manner representative of its use in practice. The test specimen shall be mounted in a supporting construction which covers the type in which it is intended to be used. The design of the connection between the doorset or openable window and the supporting construction, including any fixings and materials used to make the junction, shall be as used in practice and shall be regarded as part of the test specimen. The test specimen shall be mounted within the supporting construction so that it is flush with the exposed face of the supporting construction, unless a different position is used in practice. The whole area of the test specimen, together with at least the minimum dimensions of the supporting construction, shall be exposed to the heating conditions.

### 7.1 Supporting Construction

**7.1.1** The fire resistance of any supporting construction shall not be determined from a test in conjunction with a doorset or openable window and shall be at least commensurate with that anticipated for the product. There shall be a minimum zone of supporting construction (either brick wall, gypsum partition or any other associated supporting construction) of 200 mm wide within the furnace opening, each side and over the top of the aperture into which the test specimen is to be fixed. The thickness of the supporting construction may be increased outside of the 200 mm zone.

**7.1.2** *Standard Supporting Construction*

As prescribed in **7.1.1** of IS 16945.

However, the rules governing the applicability of the chosen standard supporting construction to other end use situations are given in **12.4** and **12.5.**

### 7.2 Gaps

**7.2.1** The adjustment of the gaps shall be within the tolerances of the design values stipulated by the sponsor. These shall be representative of those used in practice so that appropriate clearances exist, for example, between the fixed and moveable components, however in all cases the maximum gap shall not exceed 25 mm at the sill or 6 mm × 150 mm in other areas as gaps beyond these limits would constitute an integrity failure (gap gauge method).

**7.2.2** In order to generate the widest field of direct application (category B from **12.2.2**), the 'primary' gaps, that is, gaps perpendicular to the face of the leaf for hinged or pivoted doorsets or openable windows shall be set in between the middle value and the maximum value within the range of gaps for each part of the doorset or openable window as specified by the sponsor.

## 8 APPLICATION OF INSTRUMENTATIONS

### 8.1 For Temperature

**8.1.1** *Furnace Thermocouples (Plate Thermometers)*

They shall be evenly distributed over a vertical plane at 100 ± 50 mm from the nearest plane of the test construction (*see* Fig. 1). There shall be at least one plate thermometer for every 1.5 $m^2$ of the exposed surface area of the test construction, subject to a minimum of four for specimens having an area less than 6 $m^2$.

**8.1.2** *Unexposed Face Thermocouples*

**8.1.2.1** Where compliance with the insulation criteria is required to be evaluated, thermocouples of the type specified in **4.3.1.2** shall be attached to the unexposed face of the doorset or openable window for the purpose of obtaining the average and maximum surface temperatures. For leaves, the positioning of thermocouples for each leaf should be visible from the unexposed side.

**8.1.2.2** Evaluation of insulation behavior against a supplementary procedure (*see* **9.2.5**), which requires additional thermocouples, is provided in addition to the normal requirement. The sponsor may instruct the laboratory to evaluate the doorset or openable window against the supplementary procedure, if required.

**8.1.2.3** The temperature of the supporting construction in which the test specimen is mounted is not required to be measured and therefore no thermocouples are required to be attached to it.

**8.1.2.4** No thermocouple shall be placed within 100 mm (or 50 mm when evaluating as per supplementary procedure) from the centre of any component of building hardware which passes through the doorset or openable window.

**8.1.2.5** If a thermocouple has to be relocated because of the above requirements, then any other restriction, for example, the distance from the leaf edge, shall be maintained at new location. If the same situation occurs on the frame, an equivalent solution shall be followed.

NOTE — This can result in some thermocouples being positioned on elements of building hardware.

Dimensions in millimetr

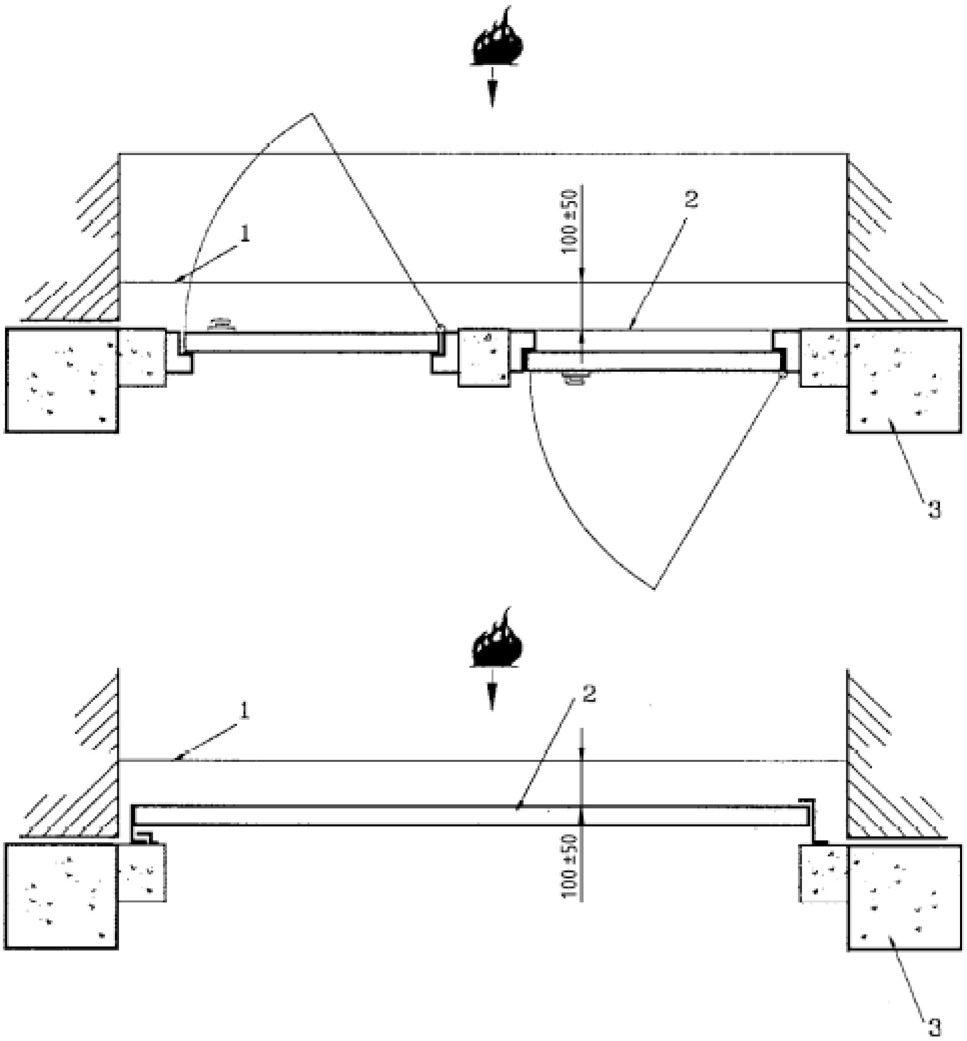

FIG.1 DISTRIBUTION OF THERMOCOUPLES

KEY

**1** Plane of furnace thermocouples
**2** Nearest plane of test construction
**3** Test frame

**8.1.3** Thermocouples are applied for determination of the maximum temperature rise of side, transom and flush over panels and discrete areas of different thermal insulation as in the case for leaves.

### 8.2 For Pressure

The pressure sensor shall be located where it will not be subjected to direct impingement of convection currents of the flames or in the path of the exhaust gases. It shall be installed such that pressure can be measured and monitored to provide conditions specified in **5.2**. The tubes used to measure pressure shall be horizontal both in the furnace and as they exit through the furnace wall, so that pressure is relative to the same positional height from the inside to the outside of the furnace.

### 8.3 For Deflection

Appropriate instrumentation shall be provided to determine a history of all significant movements perpendicular to the face of the test construction during the test. The following components are required as areas where significant movement is likely to occur:

a) leaf relative to frame, transom, over or side panel;
b) double leaf doorsets or openable windows between primary and secondary leaves;
c) frame relative to supporting construction; and
d) flexible and/or associated supporting construction.

### 8.4 For Radiation

Heat flux meters shall be as prescribed in **9.4** of IS 16945.

## 9 PERFORMANCE REQUIREMENTS

### 9.1 Integrity

**9.1.1** It is expressed as the measured time (in completed minutes) for which the test specimen continues to maintain its separating function during the test without the occurrence of the following:

a) Causing the ignition of a cotton pad applied in accordance with **10.2.1**;

b) Permitting the penetration of a gap gauge as specified in **10.2.2**; and

c) Resulting in sustained flaming.

**9.1.2** If a specimen is tested for insulation (EI), the integrity value is determined by whichever of the three criteria (a, b and c) fails first.

**9.1.3** If a specimen is tested for integrity alone (E) (or) integrity and radiation (EW), but not insulation (EI), the integrity value is determined by whichever of criteria (b,c) fails first.

NOTE — Cotton pad test is used to determine integrity failure only in insulation test.

### 9.2 Radiation

It is expressed as the measured time in completed minutes, during which the total radiation value as measured by the heat flux radiometer at 1m distance from the unexposed side is less than 15 kW/m$^2$.

### 9.3 Insulation

**9.3.1** *General*

It is expressed as the measured time, (in completed minutes) for which the test specimen continues to maintain its separating function during the test without occurrence of either of the following:

a) Increase the average temperature above the initial average by more than 140°C; or

b) Increase at any location (including the roving thermocouple) above the initial average by more than 180°C in conjunction with **9.3.4** and **9.3.5.**

When required, the test specimen shall be evaluated against the insulation levels specified in **9.3.2, 9.3.3, 9.3.4** and **9.3.5.**

**9.3.2** *Discrete Areas*

For doorsets or openable windows which incorporate discrete areas of different thermal insulation, compliance with the insulation criteria shall be determined separately for each area.

**9.3.3** *Average Temperature Rise*

Compliance shall be derived from temperatures recorded from the thermocouples specified in **10.3.1.**

**9.3.4** *Maximum Temperature Rise (Normal Procedure)*

The test specimen shall be evaluated against the maximum temperature rise criterion of 180°C above the average initial temperature with the exception that the limit for temperature rise for any perimeter frame member of the doorset or openable window shall be 360°C. Compliance shall be derived from temperatures recorded from the thermocouples specified in **10.3.1 and 10.3.2.**

**9.3.5** *Maximum Temperature Rise (Supplementary Procedure)*

The test specimen shall be evaluated against the maximum temperature rise criterion of 180°C above the average initial temperature. Compliance shall be derived from temperatures recorded from the thermocouples specified in **10.3.1, 10.3.2** and **10.3.3.**

## 10 METHODS OF TEST

### 10.1 Fire Test

This test consists of measurement of performance of three tests namely:

a) Test for integrity;

b) Test for Insulation; and

c) Test for radiation.

**10.1.1** Prior to the fire test, a pre-test examination and preparation shall be carried out in the following sequence:

a) any mechanical pre-test conditioning (for example, operability and durability of building hardwares and other elements of the test specimen) carried out by the laboratory;

b) gap measurements (*see* **10.1.2)**;

c) retention force measurements when a closing mechanism provides assistance to fire resistance by retention of the test specimen (*see* **10.1.3**); and

d) final setting (*see* **10.1.4).**

**10.1.2** *Gap Measurements*

**10.1.2.1** Gaps as defined in **3.7** shall be measured in accordance with the sequence given in **10.1.1**.

**10.1.2.2** Sufficient measurements shall be made to adequately quantify the gaps. There shall be a minimum of three measurements made along each side, top and bottom of each leaf. Measurements to determine the gaps shall be made at intervals not greater than 750 mm apart and shall be given to an accuracy not exceeding 0.5 mm. Inaccessible gaps shall be measured indirectly or calculated.

**10.1.3** *Retention Force Measurements*

**10.1.3.1** *General*

The retention forces for all doorsets or openable windows which incorporate closing devices and which are meant to be opened without the aid of mechanical power shall be measured. These measurements are needed to establish the magnitude of the forces used to retain the leaf or leaves closed to ensure that they are representative of those used in normal practice.

**10.1.3.2** *Procedure*

For each leaf, the retention force shall be determined for:

a) double action doorsets or openable windows, the force shall be determined for each direction of opening; and

b) folding doors, the force shall be determined in the direction of opening.

The retention forces for all doorsets or openable windows which incorporate closing devices operated without the aid of mechanical power shall be measured as follows:

Open each leaf slowly, using a force gauge attached to the handle and operating against the direction of closing, to a distance of 100 mm away from its closed position.

**10.1.3.3** *Recording*

Record the highest gauge reading from opening of door to 100 mm positions.

**10.1.4** *Final Setting*

**10.1.4.1** *General*

Here the doorset or openable window shall be subjected to a final closing involving opening the leaf or leaves to a distance of approximately 300 mm and returning it to the closed position. When applicable, this shall be done by the closing device. If the leaf or leaves does not contain any closing device or it cannot be used in the furnace then the leaf or leaves shall be closed by hand.

**10.1.4.2** *Procedure*

**10.1.4.2.1** When a doorset or openable window is intended to be supplied both with and without a closing device, the closing force may be released after the completion of the retention measurements required in **10.1.1.**

**10.1.4.2.2** Leaves may be latched prior to the fire test but shall not be locked unless each leaf can only be retained in the closed position during normal use by utilizing the lock (that is, there is no latch or closing device to hold each leaf in the closed position). This condition is only applicable to leaves normally maintained in a locked position. No key shall be left in the lock.

**10.1.4.2.3** If the final setting procedures are carried out with the test specimen in position on the furnace then the furnace shall be in an ambient pressure condition (that is, with no air input or extraction).

**10.2 Test for Integrity**

The integrity of separating elements shall be evaluated throughout the test by cotton wool pads, gap gauges and monitoring the test specimen for evidence of sustained flaming, unless otherwise prescribed.

**10.2.1** *Procedure A (By Cotton Pad)*

This method shall be as prescribed in **10.4.4.1** of IS 16945.

**10.2.2** *Procedure B (By Gap Gauges)*

This method shall be as prescribed in **10.4.4.2** of IS 16945. When monitoring for integrity by this method, the 6 mm gap gauge shall not be employed along the floor level, that is, only the 25 mm gap gauge shall be used at this position.

**10.3 Test for Insulation**

Temperature of the unexposed face of the test specimen to be measured as prescribed in **8.1.2, 10.3.1, 10.3.2** and **10.3.3**.

**10.3.1** *Average Temperature*

**10.3.1.1** Position five thermocouples (for single or double leaf doors), one at the centre of the leaf or leaves and one at the centre of each quarter section. These thermocouples shall not be located in any position excluded for the measurement of maximum temperature (in the normal procedure as prescribed in **10.3.2**) and shall not be closer than 50 mm to any joint, stiffener or through component, nor closer than 100 mm to the edge of the leaf or leaves.

**10.3.1.2** For a doorset or openable window which incorporates discrete areas of different thermal insulation more than 0.1 $m^2$ (for example, flush over panels, transom panels, side panels, or glazed panels within a leaf but not astragals) extra thermocouples shall be evenly distributed over the surface of those areas to determine the average temperature at a density of one thermocouple per square metre or part thereof. The average insulation performance of the sum of each type of discrete area shall be determined.

**10.3.1.3** When the total area of a single portion of the doorset or openable window represents less than 0.1 $m^2$, it shall be disregarded for the purpose of ascertaining the average unexposed face temperature.

**10.3.2** *Maximum Temperature*

**10.3.2.1** *General*

**10.3.2.1.1** The thermocouples used for measuring the average temperature rise (as given in **10.3.1**) shall also be used to measure the maximum temperature rise besides the additional thermocouples fixed as indicated in **10.3.2.2, 10.3.2.3** and **10.3.2.4.**

**10.3.2.1.2** If the doorset or openable window incorporates discrete areas of different thermal insulation more than or equal to 0.1 m$^2$ (for example flush over panels, transom panels, side panels or glazed panels within a leaf but not astragals) which are required to be evaluated separately with respect to average temperature rise, then the evaluation of maximum unexposed face temperature of those areas shall also be undertaken separately. This may require extra unexposed surface thermocouples to be applied as given in **10.3.2.3** and **10.3.2.4.**

**10.3.2.1.3** Thermocouples shall not be placed on fasteners with a surface diameter less than 12 mm.

**10.3.2.2** *Temperature of frame*

**10.3.2.2.1** Thermocouples shall be fixed at each of the following positions:

a) One at mid-height on each vertical member of the perimeter frame;
b) One on the horizontal top member of the perimeter frame and any transom fitted, at mid width. For a multi-leaf doorset or openable window, the thermocouple shall be fixed not closer than 100 mm from the visible edge of the joint on the unexposed face; and
c) One on the horizontal top member of the perimeter frame and any transom fitted, 50 mm from each corner of the frame at the point of leaf entry.

**10.3.2.2.2** At each of the above mentioned positions, the thermocouple shall be fixed as close as possible to the junction of the frame and the supporting construction, that is, the centre of the copper disc of the thermocouple shall be at 15 mm away from the junction between the frame and the supporting construction. Irrespective of this, the distance of these thermocouples from the inside edge of the frame shall not be greater than 100 mm.

**10.3.2.2.3** For the frame, thermocouples shall be placed on that part of the frame which is visible from the unexposed side. For a single leaf doorset or openable window with narrow width of opening, if the thermocouples prescribed as per **10.3.2.2.1** of point b) and c) are closer than 550 mm to each other, then thermocouple shall be placed only as per **10.3.2.2.1** of point c) above.

**10.3.2.3** *Temperature of leaf or leaves*

**10.3.2.3.1** Thermocouples shall be fixed to the face of each leaf or leaves as follows:

a) at mid-height, 100 mm away from the visible part of the vertical edges as prescribed at **10.3.2.3.3** to **10.3.2.3.6**;
b) at mid-width, 100 mm down from the visible part of the top edge as prescribed below in **10.3.2.3.3** to **10.3.2.3.6**; and
c) 100 mm away from the visible part of the vertical edges, 100 mm down from the visible part of the horizontal edge as prescribed in **10.3.2.3.2**.

**10.3.2.3.2** The inside edges of the clear face for hinged or pivoted doorsets or openable windows opening shall be towards the furnace. The other visible part of the edge of the leaf or leaves for hinged or pivoted doorsets or openable windows opening shall be away from the furnace.

**10.3.2.3.3** If due to the narrow width of a leaf or leaves, the thermocouples prescribed **10.3.2.3.1** of point b) and c) are placed closer than 500 mm to each other, then those prescribed **10.3.2.3.1** of point b) shall be omitted.

**10.3.2.3.4** If an individual leaf is less than 200 mm wide (for example, as in a multi-leaf folding shutter) then the leaves shall be treated as if they are one leaf with respect to application of unexposed face thermocouples for evaluating maximum temperature rise.

**10.3.2.3.5** Additional thermocouples shall be fixed to other areas of the leaf or leaves, for example, over any through component/connection or position where the temperature might be expected to be higher than the mean for the surface subject to the limitations given in **10.3.2.1**. The additional thermocouples shall be placed not less than 100 mm from the edges of the leaf.

**10.3.2.3.6** Where the leaf or leaves incorporate discrete areas of different thermal insulation that are required to be evaluated separately, the maximum temperature rise of these areas shall be measured from additional thermocouples. If visible part of the perimeter of the framework of the leaf is less than 115 mm wide, then the leaf shall be treated as one complete discrete area.

In all cases thermocouples shall be placed as follows:

a) If the visible width of the framework of the leaf is 115 mm or greater, position the thermocouples on the leaf at 100 mm away from the inside edges of the clear opening or from the visible part of the edge of the leaf;
b) If the visible width of the framework of the leaf is between 85 mm and 115 mm wide, position the thermocouples on the discrete area of different thermal insulation as close as possible to the framework of the leaf;
c) If the visible width of the framework of the leaf is 85 mm and below, position the thermocouples on the discrete area of different thermal insulation, 100 mm away from the inside edge of the clear opening for hinged or pivoted doorsets or openable windows opening towards the furnace;

d) If the visible width of the framework of the leaf is 85 mm and below, position the thermocouples on the discrete area of different thermal insulation 100 mm away from the visible part of the edge of the leaf for hinged or pivoted doorset or openable window, opening away from the furnace;

**10.3.2.4** *Temperatures of other areas*

**10.3.2.4.1** Thermocouples for the measurement of maximum temperature rise of side, transom and flush over panels and discrete areas of different thermal insulation shall be placed same as in the case for leaves. However, if there is more than one area of the same type then they shall be treated as one large area (as those for the average temperature rise).

**10.3.2.4.2** In addition, placing the thermocouples on flush over panels and transom panels above leaves (but not discrete panels within a leaf) shall be as follows:

a) At mid-width, 100 mm away from the horizontal edge; and

b) At the corners, 100 mm away from the vertical and horizontal edges.

The conditions prescribed for placing thermocouples on leaves of decreasing width (*see* **10.3.2.3.6**) shall also apply to transom panels, side panels and flush over panels.

NOTE — Where no evaluation of the insulation criteria is required of the doorset or openable window, or any part thereof, no temperature measurements are required.

**10.3.3** *Maximum Temperature (Supplementary Procedure)*

**10.3.3.1** *General*

This method shall be followed for evaluation of insulation criteria of leaves, wherein, it can be assumed that nobody would touch the frame, because of its position and hence, insulation criteria of frames need not be measured.

The temperature shall be determined by the thermocouples prescribed at **10.3.2**, besides the additional thermocouples fixed as indicated in **10.3.3.2** and **10.3.3.3**.

**10.3.3.2** *Temperature of leaf or leaves*

**10.3.3.2.1** Thermocouples shall be fixed to the face of each leaf as follows:

a) at mid-height, 25 mm away from the visible part of the vertical edges as prescribed at **10.3.3.2.2**;

b) at mid-width, 25 mm down from the visible part of the horizontal edge as prescribed at **10.3.3.2.2**;

c) at corners, 25 mm away from the visible part of the vertical edges, 25 mm away from the visible part of the horizontal edge as follows:

   1) At the inside edge of the clear opening, for hinged or pivoted doorsets or openable windows opening towards the furnace;

   2) At the visible part of the edge of the leaf, for hinged or pivoted doorsets or openable windows opening away from the furnace.

**10.3.3.2.2** Additional thermocouples shall also be placed to other areas of the leaf or leaves, e.g. over any through component/connection or position where the temperature might be expected to be higher than the mean, subject to the limitations given in **8.1.2** and **10.3.2.1**.The additional thermocouples shall be placed not less than 25 mm away from the edges of the leaf. Where the leaf or leaves incorporate discrete areas of different thermal insulation that are required to be evaluated separately, the maximum temperature rise of these areas shall be measured using additional thermocouples. If any visible part of the perimeter of the framework of the leaf is less than 40 mm wide, the leaf shall be treated as one complete discrete area.

In such cases thermocouples shall be placed as follows:

a) If the visible width of the framework of the leaf is more than or equal to 40 mm , position the thermocouples on the leaf at 25 mm from the inside edges of the clear opening or from the visible part of the edge of the leaf, as defined in **10.3.3.2** above;

b) If the visible width of the framework of the leaf is between 10 mm and 40 mm, position the thermocouples on the discrete area of different thermal insulation as close as possible to the framework of the leaf;

c) If the visible width of the framework of the leaf is less than or equal to 10 mm, position the thermocouples on the discrete area of different thermal insulation at 25 mm away from the inside edge of the clear opening for hinged or pivoted doorsets or openable windows opening towards the furnace;

d) If the visible width of the framework of the leaf is less than or equal to 10 mm, position the thermocouples on the discrete area of different thermal insulation at 25 mm away from the visible part of the edge of the leaf for hinged or pivoted doorsets or openable windows, opening away from the furnace;

e) If due to the narrow width of a leaf or leaves, the thermocouples prescribed at b) and c) are closer than 575 mm to each other, then the condition prescribed at b) shall be omitted;

f) If a leaf is less than 200 mm wide (for example as in a multi-leaf folding shutter) then the leaves shall be treated as one leaf with respect to application of unexposed face thermocouples for evaluating maximum temperature rise.

**10.3.3.3** *Temperature of other areas*

**10.3.3.3.1** Thermocouples for the determination of the maximum temperature rise of side, transom and flush over panels and discrete areas of different thermal insulation shall be applied as in the case for leaves. However, if there is more than one above such area of the same type, then they shall be treated as one large area (as those for the average temperature rise).

**10.3.3.3.2** Additional thermocouples shall be placed on flush over panels and transom panels above leaves (but not discrete panels within a leaf) as prescribed below:

a) at mid-width, 25 mm away from the horizontal edge; and
b) at a point 25 mm away from both the edges at the corner.

The rules for reducing the number of thermocouples on leaves of decreasing width shall also apply to transom panels, side panels and flush over panels.

### 10.4 Test for Radiation

The measurement of radiation shall be taken by the method as prescribed in **10.4.6** of IS 16945.

### 10.5 Deflection

Deflection shall be measured against a fixed datum. The frequency of measurement of deflection of the specimen shall be such that a clear picture of history of the deflection of the test specimen throughout the test duration is obtained. The other details are prescribed in **8.3**.

NOTE — Measurement of deflection is a mandatory requirement although; there are no performance criteria associated with it. Information regarding the relative deflection between components of the test specimen, between the test specimen and the supporting construction and of the supporting construction itself may be important in determining the field of extended application of the test results.

## 11 TEST REPORT

By prior agreement with the test sponsor, additional information may be obtained for individual elements of building hardware. Based on the observations recorded during the test, the results may be reported in a separate report.

### 11.1 Full Test Report

The test report shall contain the following information:

a) The name and address of the testing laboratory;
b) The name and address of the sponsor;
c) The date of the test;
d) The unique reference number of the test, if any;
e) The name of the manufacturer (if known) of the test specimen and, of the products and components used in the construction, together with identification marks and trade names;
f) The construction details of the test specimen, including description and drawings and principal details of the components. The description and the drawings which are included in the test report shall, be based on the information (as far as practicable) provided by the sponsor and verified by the survey of the test specimen. When full and detailed drawings are not produced by the laboratory in their report, then the sponsor's drawing(s) of the test specimen shall be authenticated by the test laboratory. At least one copy of the drawing(s) shall be included in the test report. Reference shall be given in the report that the drawings are those provided by the sponsor;
g) Detailed description of the associated supporting construction, as appropriate. The details of the associated supporting construction shall be verified and described as those of the test specimen;
h) The relevant properties of materials and components that have bearing on the fire performance of the test specimen. Where it is impracticable to measure some of these properties, this shall be reported;
j) The method of assembly and installation of the test specimen;
k) Details of pre-testing conditions of the specimen;
m) A statement regarding the 'decision of the laboratory' in the selection of the test specimen, if applicable;
n) The support and restraint conditions employed during the test and the reason for their selection;
p) For asymmetrical separating elements, the direction in which the specimen was tested and the reason thereof;
q) Information regarding the location of all the thermocouples fixed to the specimen, pressure measurement and deflection measurement devices. Drawings shall be included which clearly illustrate the positions of the various devices and identify them relative to the data provided;
r) The ambient temperature of the laboratory at the commencement of the test;
s) The pressure conditions within the furnace relative to the position of the test construction;
t) Temperature/time curves of the furnace heating conditions;
u) The reasons conforming that the tolerances on the temperature/time curve, pressure conditions or ambient laboratory conditions are within the limits as prescribed in **5**;

- v) The result slated in terms of the elapsed time (in completed minutes), from the commencement of heating to the time of failure taking into account the relevant criteria including:
  1) The rate of deflection, when same is the criterion used to assess load bearing capacity (including the value of *d* used in calculating the limiting rate of deflection for flexural members);
  2) The maximum deflection and the time and position at which it occurred, supported by adequate graphical data;
  3) The mode of failure with respect to all integrity criteria;
  4) The position(s) at which the maximum temperature rise was observed should this be the cause of insulation failure;
  5) Any alternative and additional tests.
- w) Output in the form of tables and/or graphs from all pressure measurement devices, deflection measurement devices, unexposed face thermocouples and where applicable, internal thermocouples;

  NOTE — The report only needs to include a selection of the measured data, sufficient to provide a history of the performance of the test specimen. For example, it is not necessary to tabulate the temperature of every thermocouple fixed to a beam at 1 min intervals for the whole duration of the 90 min test. However, it is recommended that all the measurements be included at around the time of failure of all the criteria being considered. Before and after this period the interval at which measured data needs to be included in the report may be longer, for example, at intervals of 5 to 10 min.
- y) A description of the any significant behavior of the test specimen;
- z) The field of direct application of the results for the specimen, in accordance with **12**;
- aa) The following statements:

  "This report details the method of construction, the test conditions and the results obtained when the specific element of construction described herein was tested following the procedure outlined in IS 16947. Any significant deviation with respect to size, construction details, loads, stresses, and edge or end conditions other than those allowed under the field of application in the relevant test method is not covered by this report".
- bb) Any other declaration as identified and having legal implications of the reported test results may be furnished by the lab.

## 11.2 Short Form Test Report

In addition to the full test report, a concise version of report may also be provided at the specific request of the sponsor. It shall include all the items listed in **11.1**. However items f), h), j), k), m), n), p), s), t), v) and w) may be shortened.

## 11.3 Illustrative Guide for expression of Test Results in the Test Report

**11.3.1** An example for expressing the test results is given below, for a separating element, where the integrity and insulation criteria were exceeded and the test was discontinued at the request of the sponsor.

- a) Integrity — Sustained flaming, 128 min, no failure (the test having been discontinued at the request of the sponsor)
  1) Gap Gauge : 124 min
  2) Cotton Pad : 120 min
  3) Insulation : 110 min

**11.3.2** Another example of the method for expressing the results is given below for a non-load bearing element:

- a) Integrity — Sustained flaming, 132 min no failure (the test having been discontinued at the request of the sponsor)
  1) Gap Gauge : 132 min
  2) Cotton Pad : 132 min
  3) Insulation : 20 min
  4) Radiation : 66 min

**11.3.3** In addition to the above, the following shall also be included in the test report:

- a) Reference that the test was carried out in accordance with IS 16947;
- b) Details of how the test specimen was verified in line with **6.5**;
- c) A reference to which standard supporting construction was chosen, if appropriate;
- d) A description of the type of floor covering, if any, used in the test construction;
- e) The gap measures as prescribed in **10.1.2**;
- f) The retention forces as measured according to **10.1.3**;
- g) The results stated in terms of the elapsed time, (in completed minutes), from the commencement of the test to the time to failure of integrity and when required, the time of failure of radiation criteria and, when required, the time to failure of insulation; and
- h) In cases where the sponsor has requested that the test be continued beyond the first failure, all observed failures during the test shall also be recorded.

**11.3.4** On request of the test sponsor, a separate report can be produced to cover the performance of individual elements of building hardware. The separate report containing the minimum following information could be provided.

a) Reference to the full test report;
b) The name of the producer/supplier of the item of building hardware under test, its trade name and/or the manufacturer's code for the product, a visual representation and a full description of the product including any protection, with particular reference to dimension of components, location and fixing details and materials used within the building hardware items;
c) A description of the associated construction with applied protection adjacent to the item of building hardware; and
d) The duration for which the test specimen complied with the relevant criteria, expressed in minutes from the start of the test.

NOTE — The field of direct application may only be defined, following the identification of classification(s). The field of direct and, where applicable, extended application will be included in the classification report.

## 12 FIELD OF DIRECT APPLICATION OF TEST RESULTS

The field of direct application defines the allowable changes to the test specimen following a successful fire resistance test. The allowable variations can be introduced automatically without the need for the sponsor to seek additional evaluation, calculation or approval. The field of direct application of test results is restricted to doorsets. The field of direct application rules for openable windows is restricted to test specimen subjected to fire resistance test.

NOTE — When extended product size requirements are envisaged, the dimensions of certain components within the test specimen can be less than those intended to be used, at full size in order to maximize the extrapolation of the test results by modeling the interaction between components at the same scale.

### 12.1 Materials and Construction

**12.1.1** Unless otherwise stated in **12.1.2**, the materials and construction of the doorset shall be the same as tested. The number of leaves and the mode of operation (for example, sliding, swinging, single action or double action) shall not be changed.

**12.1.2** *Specific Restrictions on Materials and Construction*

**12.1.2.1** *For timber constructions*

a) The thickness of the door leaf or leaves shall not be reduced but may be increased. For doorsets with multiple leaves, the thickness of door leaves shall be increased by equal amount. For timber based board products (particle board, blockboard, etc), the composition (type of resin) shall not change from that tested. The density shall not be reduced but may be increased. The door leaf thickness and/or density may be increased provided the total increase in weight is not more than 25 percent.
b) The number, size, location and orientation of any joints in the timber framing shall not be changed.
c) The cross-sectional dimensions and/or the density of the timber frames (including rebates) shall not be reduced from that tested but may be increased.

**12.1.2.2** *For metal constructions*

a) The dimensions of metal wrap around frames may be increased proportionally to accommodate increased supporting construction thickness. The thickness of the metal may also be increased by up to 25 percent. The type of metal shall not be changed from that tested.
b) The number of stiffening elements for uninsulated doorsets and the number and type of fixings of such members within the fabricated panel may be increased proportionally with the increase in size and shall not be reduced.

**12.1.2.3** *For glazed constructions*

The type of glass and the edge fixing technique, including type and number of fixings per metre of perimeter, shall not be changed from those tested. The number of glazed apertures and dimensions (width and height) of glass of each pane used in a test specimen shall not be increased but may be decreased accordingly:

a) in proportion with door size reductions;
b) by maximum of 25 percent for integrity only and/or radiation control doorsets and for doorsets which satisfy the insulation criteria where the unexposed surface temperature for both the door leaf and the glazing have been maintained for the classification period; or
c) without restriction provided that the total area of the tested pane(s) is less than 15 percent of the door leaf or side/over panel area.

The distance between the edge of glazing and the perimeter of each leaf, or the distance between glazed apertures shall not be reduced from those incorporated in test specimens. Other repositioning within the leaf can only be carried out if the same does not involve the removal or repositioning of structural members relative to the glazing.

**12.1.3** *Decorative Finishes*

**12.1.3.1** *Paint finish* — Where the paint finish has no contribution to the fire resistance of the doorset alternative paints are acceptable and may be added to leaves or frames for which unfinished test specimens were tested. Where the paint finish contributes to the fire resistance of the doorset (for example, intumescent paints) then changes are not permitted.

**12.1.3.2** *Decorative laminates finish* — Decorative laminates and timber veneers up to 1.5 mm thickness can be added to the faces (but not the edges) of leaves and frames in doorsets which satisfy the insulation criteria (normal or supplementary procedure).

**12.1.3.3** Decorative laminates and timber veneers cannot be applied to doorsets which do not satisfy the insulation criteria (normal or supplementary procedure) unless subjected to a fire test. Decorative laminates and timber veneers in excess of 1.5 mm thickness shall be tested as part of the test specimen. For doorsets tested with decorative laminate faces, the only variations possible are changes in colour, pattern, manufacturer for similar type and thickness of the material.

**12.1.4** *Fixings*

The number of fixings used to attach doorsets to supporting constructions may be increased but shall not be decreased from that tested. The distance between fixings may be reduced accordingly.

**12.1.5** *Building Hardware*

**12.1.5.1** The number of components restricting the movement such as locks, latches and hinges may be increased from that tested and shall not be decreased.

**12.1.5.2** Where a doorset has been tested with a closing device, the doorset may be provided either with or without that closing device, that is, where self closing characteristics are not required.

NOTE — Exchange of building hardware is not covered by the field of direct application.

**12.2 Permissible Size Variations**

**12.2.1** *General*

**12.2.1.1** Doorsets of sizes different from those of the tested specimen are permitted within certain limitations but the variations depends on product type and the length of time that the performance criteria are fulfilled.

**12.2.1.2** The changes in dimensions permitted under the field of direct application (*see* **12.1**) are applicable to the overall size of each leaf, each side panel, each transom panel and each over panel independently and including any rebates which may be present on the leaf or panel.

**12.2.1.3** The dimensions (width and height) of any glass pane cannot be increased in view of **12.1.2.3**.

**12.2.2** *Test Periods*

Table 1 prescribes classifications times for category A and category B at which specimen withstand the test. The amount of variation of size permitted depends whether the classification time just reached as prescribed for Category A or Category B.

**Table 1 Classification into Categories A and B**

(*Clause* 12.2.2)

| Classification time for Category A (min) | Overrun Time Required for Category B (min) |
|---|---|
| 15 | 18 |
| 20 | 24 |
| 30 | 36 |
| 45 | 52 |
| 60 | 68 |
| 90 | 100 |
| 120 | 132 |
| 180 | 196 |
| 240 | 260 |

**12.2.3** *Size Variations Related to Product Type*

**12.2.3.1** *General*

**12.2.3.1.1** The rules that govern increase or decrease of size without additional considerations are applicable only to hinged or pivoted doorsets.

**12.2.3.1.2** Doorsets that satisfy both the radiation control levels and insulation criteria may have their sizes increased. This is because any increase in size will increase the radiation received at a fixed distance away from the doorset. This is accepted because the increase in radiation resulting from a size increase for an insulated doorset as it will still satisfy the required radiation control levels. Size decreases are permitted for both doorsets which satisfy radiation control levels and for those which satisfy insulation criteria and radiation control levels.

**12.2.3.2** *Hinged or pivoted doorsets*

**12.2.3.2.1** For category ‘A’ classification (with no overrun of classification period) no size increase is allowed. Unlimited reductions from the tested specimen are permitted with the exception of insulated metal doorsets where the size reduction is limited (*see* Annex A).

**12.2.3.2.2** For category ‘B’ classification (with overrun in accordance with **12.2.2**) increases are permitted provided that the doorset is tested with the ‘primary’ gaps, (gaps perpendicular to the face of the leaf or leaves) set between the middle value and the maximum value as declared by the sponsor as stated in **7.2**. If the gaps were not set according to **7.2**, then no size increases are permitted for category ‘B’ classification. However, the test result is still applicable to doorsets with gaps less than the average of the medium and maximum measured values (*see* Annex A).

**12.2.3.2.3** *Other changes*

a) For smaller doorset sizes, the relative positioning of components which restrict movement (for example, hinges, latches, etc) shall remain the same as tested. Any change to the distances between them will be limited to the same percentage reduction as the decrease of test specimen size.

b) For larger doorset sizes the following shall also apply:

   1) the height of the latch above floor level shall be equal to or greater than the tested height, and the maximum of any change in height shall be proportional to the increase in the height of the doorset;
   2) the distance of the top hinge from the top of door leaf shall be equal to or less than that tested;
   3) the distance of the bottom hinge from bottom of door leaf shall be equal to or less than that tested; and
   4) where three hinges or distortion preventers are used, the distance between the bottom of the door leaf and centre restraint shall be equal to or greater than that tested.

**12.2.3.2.4** *Side and transom panels*

The variation in tested specimens of side and transom panel arrangements are the same as those applied generally to hinged or pivoted doorsets.

Due to the constraints of the furnace size, if only one side panel could be tested, provided conforming to type 'B' overrun classification, a second panel up to the same size may be added to the opposite side. Where an additional side panel is to be added to a tested single-leaf doorset then the tested panel shall be positioned on the latch side.

The addition of a second side panel is only allowed for doorsets which satisfy the radiation criteria and the insulation criteria (*see* **12.2.3.1**).

**12.2.3.2.5** *Timber constructions*

Where decorative timber veneers more than 1.5 mm thick, or other claddings which themselves provide constructive benefits, are part of the test specimen, they shall not be substituted with alternatives of lesser thickness or strength.

### 12.3 Asymmetrical Doorsets

Separating elements required to be fire resisting from both sides, two test specimens shall be tested (one for each direction) unless the element is fully symmetrical, i.e. the construction of the doorset is identical on both sides of a centre line through the thickness of the door leaf when viewed in plan (from above). However, in some cases it is possible to develop rules whereby the fire resistance of an asymmetrical doorset tested in one direction shall also apply when the fire exposure is from the other direction to asymmetrical doorset. The rules in **12.3.1** represent the minimum level of common agreement which shall be followed.

**12.3.1** *Specific Rules*

The rules governing the applicability of tests carried out in one direction to other directions are given in Table 2. They are based on the following premises:

a) Each of the leaves are themselves of symmetrical construction with the exception of the edges, for example, lock/leading edge and hinge edge or double rebated doors;

b) Any restraining/supporting elements of building hardware have a melting point not less than 1 000°C, or the element of building hardware previously satisfied a test as per this Indian Standard, when exposed in both directions and will retain their function to the exposed heat during the test;

c) There is no change in the number of leaves or the mode of operation, for example, sliding, swinging, single action or double action; and

d) Side, over and transom panels are excluded from Table 2 unless they are fully symmetrical.

Table 2 lists the type of doorset for which rules can be generated for the direction in which it should be tested to cover the opposite direction. The separate columns for the integrity and insulation criteria reflect the different conditions to deriver the rules for integrity only doors as opposed to those which satisfy both criteria. 'Yes' means that it is possible to identify the direction of test which also satisfy the opposite direction. 'No' indicates that it is not feasible to identify the direction which will also satisfy the opposite direction.

**Table 2 — Type of Doorset and Direction to be Tested to Cover the Opposite Direction**

(*Clause* 12.3.1)

| Type of doorset | Direction to be tested to cover opposite direction | Integrity and radiation | Insulation |
|---|---|---|---|
| Hinged or pivoted, timber leaf, timber frame | Opening towards the furnace | Yes | Yes |
| Hinged or pivoted, timber leaf, metal frame (no transom) | Opening towards the furnace | Yes | No |
| Hinged, metal leaf, metal frame (not pivoted) | Opening away from the furnace | Yes | No |

### 12.4 Supporting Constructions

**12.4.1** *General*

The fire resistance of a doorset tested in one form of standard supporting construction may or may not apply when it is mounted in other types of construction. Generally, the rigid and flexible types are not interchangeable and rules governing the direct application within each group are given in **12.4.2** and **12.4.3**. However, in some cases it is possible for the result of a test on a particular type of doorset tested in one form of standard supporting construction will also be valid for that doorset when mounted in a different type of standard supporting construction. Specific rules governing the situation for hinged or pivoted doorsets are given in **12.4.3**.

**12.4.2** *Rigid Standard Supporting Construction (High or Low Density)*

The fire resistance of a doorset tested in **a** high or low density rigid standard supporting construction can be applied to a doorset mounted in the same manner in a wall provided the density and the thickness of the wall are equal to or greater than that in which the doorset was tested.

**12.4.3** *Specific Rules for Hinged or Pivoted Doorsets, Openable Windows and Sliding Doors*

a) For timber door leaves hung in timber frames the result of a test in a rigid standard supporting construction is also valid for that doorset mounted in a flexible construction.
b) For timber door leaves hung in timber frames, the result of a test in a flexible standard supporting construction is valid for that doorset mounted in a rigid construction.
c) For timber door leaves hung in metal frames the result of a test in a flexible standard supporting construction is applicable to that doorset mounted in a rigid construction but not vice versa.
d) For insulated metal door leaves hung in metal frames there is no applicability of results in rigid standard supporting construction to flexible constructions or vice versa. To cover rigid and flexible types, tests shall be undertaken in each type of standard supporting construction.
e) For uninsulated metal doorsets, the result of a test in a rigid standard supporting construction is applicable to that doorset mounted in a flexible construction, but not vice versa.

**12.4.4** The rules above are true when the fixing methods used in each type of supporting construction are appropriate to that construction. For example in a), the test on the timber door leaf in a timber frame would have been carried out with appropriate fixings for timber frames in rigid constructions. The result is equally valid for a timber door leaf in a timber frame mounted into a flexible construction with appropriate fixings for timber frames in flexible constructions.

### 12.5 Associated Supporting Constructions

The fire resistance of a doorset tested along with an associated supporting construction is not valid for change in field of direct application. The applicability of the result to other supporting constructions shall be the subject of extended application.

# ANNEX A

(*Clause* 12.2.3.2)

## FIELD OF DIRECT APPLICATION LIMITS OF PERMITTED SIZE VARIATIONS

**Table A.1 — Field of Direct Application — Limits of Permitted Size Variations**

| Type of doorset | Category 'A' allowances | Category 'B' allowances |
|---|---|---|
| Hinged or pivoted doorsets | Unlimited size reduction is permitted for all types except insulated metal doorsets where a reduction to 50 percent width and 75 percent height of the tested specimen is the limit of variation. Size increase is not permitted. | Unlimited size reduction is permitted for all types except insulated metal doorsets where a reduction to 50 percent width and 75 percent height of the tested specimen is the limit of variation. Size increase is permitted except for those which satisfy integrity with radiation levels up to:<br>15 percent height<br>15 percent width<br>20 percent area |

## A-1 EXAMPLE

**A-1.1** For a double leaf doorset with equal width leaves and category 'B' overrun time, the tested overall door leaf width (for example 1 600 mm) can be increased for the door leaves by + 15 percent to overall 1 840 mm. Each leaf could be increased equally by 15 percent up to 920 mm. For an insulated hinged or pivoted doorset, one leaf could be increased by 15 percent up to 920 mm whilst the other leaf could be decreased by 50 percent to 400 mm.

NOTE — In this latter case, the full extended width of 1 840 mm could not be achieved.

**A-1.2** If these relationships, particularly the latter one for unequal leaves, are still not sufficient to cover a manufacturer's needs, then a test specimen with unequal leaves could be tested following which, with a category 'B' overrun, the increase and decrease rules could be applied individually to each leaf in turn.

**A-1.3** For all doorsets which include unequal width leaves, the 50 percent reduction will apply to both insulated and non-insulated products.

**Bureau of Indian Standards**

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

**Copyright**

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Director (Publications), BIS.

**Review of Indian Standards**

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

This Indian Standard has been developed from Doc No.: CHD 10 (02097).

## Amendments Issued Since Publication

| Amend No. | Date of Issue | Text Affected |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

**BUREAU OF INDIAN STANDARDS**

**Headquarters:**

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
*Telephones*: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

| **Regional Offices:** | | *Telephones* |
|---|---|---|
| Central | Manak Bhavan, 9 Bahadur Shah Zafar Marg<br>NEW DELHI 110002 | 2323 7617<br>2323 3841 |
| Eastern | 1/14 C.I.T. Scheme VII M, V.I.P. Road, Kankurgachi<br>KOLKATA 700054 | 2337 8499, 2337 8561<br>2337 8626, 2337 9120 |
| Northern | Plot No. 4-A, Sector 27-B, Madhya Marg<br>CHANDIGARH 160019 | 265 0206<br>265 0290 |
| Southern | C.I.T. Campus, IV Cross Road, CHENNAI 600113 | 2254 1216, 2254 1442<br>2254 2519, 2254 2315 |
| Western | Manakalaya, E9 MIDC, Marol, Andheri (East)<br>MUMBAI 400093 | 2832 9295, 2832 7858<br>2832 7891, 2832 7892 |

**Branches** : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. COIMBATORE. DEHRADUN. DURGAPUR. FARIDABAD. GHAZIABAD. GUWAHATI. HYDERABAD. JAIPUR. JAMMU. JAMSHEDPUR. KOCHI. LUCKNOW. NAGPUR. PARWANOO. PATNA. PUNE. RAIPUR. RAJKOT. VISAKHAPATNAM.

Published by BIS, New Delhi